

Mercury Conditions for the MESSENGER Mission Simulated in High-Solar-Radiation Vacuum Tests

The MESSENGER (Mercury Surface, Space Environment, Geochemistry, and Ranging) spacecraft, planned for launch in March 2004, will perform two flybys of Mercury before entering a year-long orbit of the planet in September 2009. The mission will provide opportunities for detailed characterization of the surface, interior, atmosphere, and magnetosphere of the closest planet to the Sun. The NASA Glenn Research Center and the MESSENGER spacecraft integrator, the Johns Hopkins University Applied Physics Laboratory, have partnered under a Space Act Agreement to characterize a variety of critical components and materials under simulated conditions expected near Mercury. Glenn's Vacuum Facility 6, which is equipped with a solar simulator, can simulate the vacuum and high solar radiation anticipated in Mercury orbit.

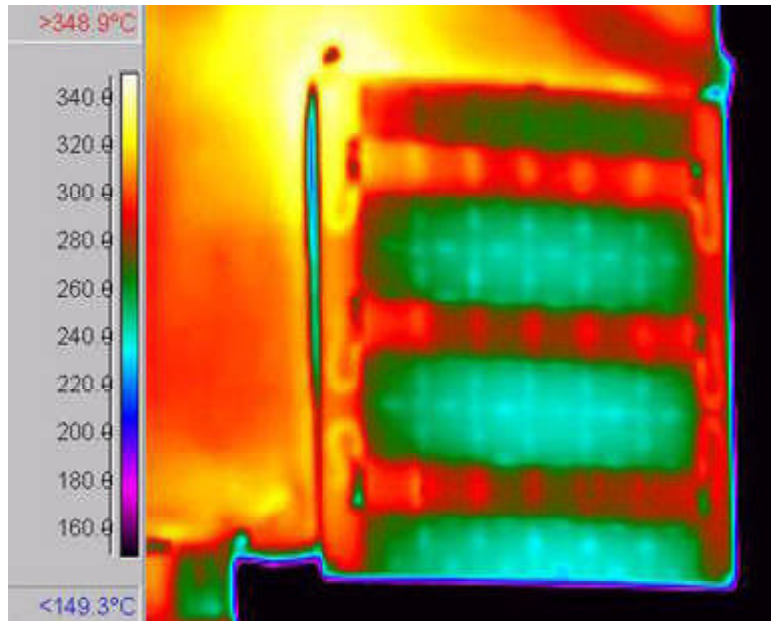


MESSENGER test hardware in the Tank 6 solar thermal vacuum facility.

The MESSENGER test hardware includes a variety of materials and components that are being characterized during the Tank 6 vacuum tests, where the hardware will be exposed to up to 11 suns insolation, simulating conditions expected in Mercury orbit.

In 2002, ten solar vacuum tests were conducted, including beginning of life, end of life, backside exposure, and solar panel thermal shock cycling tests. Components tested include candidate solar array panels, sensors, thermal shielding materials, and communication devices. As an example, for the solar panel thermal shock cycling test, two candidate solar array panels were suspended on a lift mechanism that lowered the panels into a liquid-

nitrogen-cooled box. After reaching -140 °C, the panels were then lifted out of the box and exposed to the equivalent of 6 suns (8.1 kW/m²). After five cold soak/heating cycles were completed successfully, there was no apparent degradation in panel performance. An anticipated 100-hr thermal shield life test is planned for autumn, followed by solar panel flight qualification tests in winter. Glenn's ongoing support to the MESSENGER program has been instrumental in identifying design solutions and validating thermal performance models under a very aggressive development schedule. The test data have assisted Johns Hopkins engineers in selecting a flight solar array vendor and a thermal shield design. MESSENGER is one in a series of missions in NASA's Discovery Program.



Infrared thermograph of a candidate MESSENGER solar array panel.

Infrared thermography provides data on the thermal gradients in the MESSENGER components during high solar insolation vacuum testing.

Find out more about MESSENGER.

Glenn contact: Wayne A. Wong, 216-433-6318, Wayne.A.Wong@nasa.gov

Author: Wayne A. Wong

Headquarters program office: OSS

Programs/Projects: Discovery, MESSENGER